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Oral health of 20-25 years-old young adults according to the Caries Assessment Spectrum and Treatment CAST) index in Konya, Turkey

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Abstract

The index of Caries Assessment Spectrum and Treatment CAST) reveals a range of caries development from a non-cavitated status to advanced lesions. The aim of the present study was to explore the oral health status of 20-25 years old young adults based on the CAST index in Konya, Turkey. This study was conducted on 100 young adults 20-25 years old of age were used to identify individuals at risk of caries. Patients were informed about the study and informed consent form was taken. Clinical and radiographic examinations of the patients were performed. The prevalence of CAST categories was evaluated with regard to the first and second permanent molars by one examiner. The Spearman's rank correlation coefficient was used to explore the correlation of the distribution of CAST codes among the evaluated teeth. The intra-examiner reliability was determined by the unweighted kappa coefficient. The level of statistical significance was established at $p < 0,05$. Regarding the molars, the first molars were affected by 80%, while the second molars were 67% caries or restorations, and most lesions were scored at the non-cavitation level. The lower first and second molars were more affected by uppers. Teeth with pulpal problem, sepsis and extracted due to caries were found to be more prevalent in first, and then in second molars. A strong correlation was found between the status of teeth from the right and left sides of the oral cavity. The correlation of the status of first and second teeth was stronger for the right than for the left side of the mouth, r was 0.603 and 0.456 in maxilla and 0.546 and 0.361 in mandible $p < 0,001$), respectively. The intra-examiner reliability was established at 0.80 for permanent molars.

Keywords: Caries Assessment Spectrum and Treatment, index

Introduction

Dental caries remains a serious problem in many societies worldwide, with a marked increase in incidence in many countries over the past decade. Continuous monitoring of the dental epidemiological situation is important. The Caries, Missing and Filled Teeth DMFT) index, which is the most frequently used tool in epidemiological research, was in use in the last century, with recommendations of the World Health Organization, but could not meet the difficulties of recent clinical research details. While this index provides information about caries and missing teeth, it is insufficient to provide information on clinical outcomes such as whether untreated dental caries is pulp- related or causes dental abscess. In addition, the detection of lesions that have not yet cavitated due to caries is an important issue in populations with high caries prevalence.

The use of the International Caries Detection and Evaluation System ICDAS), in which enamel lesions are distinguished in detail in three stages, has recently enabled researchers.[3] However, the system requires the use of compressed air to dry the tooth surfaces and double-checking the teeth, such detailed assessments are costly and time consuming. For populations with a high prevalence and severe course of caries, tools such as the PUFA and PRS index have been proposed to determine the results of the untreated dental caries index. While PUFA and PRS are of great interest, the disadvantages are that they only cover a portion of the caries stages and only complement the DMFT or ICDAS. In practical terms, the most advantageous solution in epidemiological research is to use a single index that describes the full persistence of a disease. Recently, details of the innovative index for epidemiological studies called Caries Assessment Spectrum and Treatment CAST) have been described in a series of articles by Frencken [6, 7].

An innovation of CAST is that it considers teeth with restorations as healthy, in line with epidemiological studies. It was suggested that special attention should be paid to a modern way of assessing the face and content validity of this index through the RAND modified e- Delphi consensus method, and 56 researchers from 24 countries were involved in this process. CAST has already been validated in extensive *in vitro* and *in vivo* studies that have proven its high specificity, sensitivity, and reliability in epidemiological studies. [9,10] However, CAST must be tested in independent studies before it can be established as a suitable epidemiological index. Some universal patterns can be seen in caries, for example: caries levels follow trend lines, there is a specific mathematical relationship between mean DMFT and DMFS, and mean DMFT for individuals Changes in scores are not linear.Regularities in the distribution of caries have also been found regarding teeth, regions and specific groups. Three patterns in the distribution of dental caries have been evaluated: random, holistic and regular, but the hypothesis that teeth are randomly infected with caries has been rejected. Over the years, the concept of regular occurrence of caries, i.e. a symmetrical prevalence in the midline and between the upper and lower jaws, has become so widely accepted that some measures have assessed the level of caries by doubling the dental arch in the examination results. However,

Vannonberg *et al* [16]. reported that at the population level, caries tend to be symmetrically distributed, but at the individual level they may be concentrated on one left or right) side of the mouth. Batchelor [14] and Sheiham [11] confirmed that no absolute caries symmetry occurs, but groups of teeth with similar susceptibility. The symmetrical appearance of lesions resulted in a gradual pattern of disease levels, i.e. decreasing or increasing the course of caries on the jaws. Most of the research on caries pattern is based on dental evaluation according to DMFT. In our country, the number and importance of oral health and caries research has gradually increased. Our research team has studied the distribution, levels, prevalence and effectiveness of preventive treatments in different risk groups for the last 10 years. Only one study has been published in our country on the applicability of the CAST index in clinical patients. This study was designed as part of a comprehensive series of studies and presents data based on CAST. The aim of this study was to examine the effectiveness of using the current Caries Assessment Spectrum and Treatment CAST) index in molars of young 20-25 years-old adults.

Materials and methods

In order to carry out our study, individuals were informed and consent forms were obtained after obtaining the necessary permission in accordance with the 2012/10 decision dated 04.10.2012 of the Non-Interventional Clinical Research Ethics Committee of Selcuk University Faculty of Dentistry. 100 individuals aged between 20-25 years old who came to the restorative dentistry clinic were randomly included in this study. The clinical examinations of the individuals were performed by an experienced researcher, according to the World Health Organization WHO) criteria, with the help of a mirror and probe under the reflector light. In the clinical evaluation, teeth with definite caries were accepted as caries, teeth with restoration were considered as filling, and teeth extracted due to caries were considered as missing. Initial enamel lesions and white-brown stains were considered as intact. 800 lower and upper first and second molars of the individuals were examined in detail with the CAST index. The dental examination was performed by a researcher with ten years of experience in epidemiological research. Teeth were evaluated according to the CAST recommendations set. The CAST Index has a hierarchical structure and covers all stages of caries, from a solid surface, fissure sealant applied, restoration, enamel and 3-level dentin carious lesions, pulp and periapical inflammation to tooth loss due to caries Table 1).

Table: CAST Index Definitions

Code	Characteristics	Description
0	Sound	No visible evidence of a distinct carious lesion is present
1	Sealant	Pits and /or Fissures are at least partially covered with a sealant material
2	Restored	A cavity is restored with an (in) direct restorative material
3	Enamel	Distinct visual change in enamel only. A clear caries related discoloration is visible, with or without localized enamel breakdown
4	Dentine	Internal caries-related discoloration in dentine. The discolored dentine is visible through enamel which may or may not exhibit a visible localized breakdown of enamel
5	Dentine	Distinct cavitation into dentine. The pulp chamber is intact
6	Pulp	Involvement of pulp chamber. Distinct cavitation reaching the pulp chamber or only root fragments are present
7	Abscess/fistula	A pus containing swelling or a pus releasing sinus tract related to a tooth with pulpal involvement
8	Lost	The tooth has been removed because of dental Caries
9	Other	Does not correspond to any of the other descriptions

The prevalence of certain conditions ranging from initial lesions of the tooth to extraction of the tooth has been noted by Frencken [6, 7]. Before the examination, the researchers conducted a training session consisting of theoretical and practical parts. The theoretical part includes the study of literature and materials provided by the authors of the CAST index; The extracted molars were then evaluated for suitability of CAST codes. While applying the CAST index, individuals' first and second molars were evaluated in a clinical environment with their first and second molars brushed. The condition of the surface of each tooth was recorded separately on a form developed for this study. If

two different code conditions existed on the same surface, for example, restoration on one surface and enamel lesion on the other, or enamel lesion on one surface and profund stage on the other, the higher code was recorded. 15 of the individuals evaluated were repeated at the next restorative appointment one week later to determine intraob server reliability by the same researcher. The data obtained as a result of the measurements made during the study were evaluated using the SPSS statistical package program SPSS Statistictics 17.0, Chicago, USA) in the Windows environment. While descriptive statistics were sufficient to determine the distribution of teeth and codes, the Spearman rank correlation coefficient was used to investigate the correlation of the distribution of CAST codes among the evaluated teeth. Intra-examiner reliability was determined by kappa coefficient. Statistical significance level was determined as $p < 0.05$.

Results

The findings resulting from the CAST index and tooth matching made with descriptive statistics are presented in table 2. Regarding the molars, 80% of the first molars were affected, while 67% caries or restoration was observed in the second molars, and most of the lesions were affected. was scored at the non- cavitation level. The lower first and second molars were found to be more affected than the upper ones. While most of the first molars of 20-25 years-old individuals were restored, a small number were found to be missing. The decay rate was found to be less than the restoration. Interface or total restoration losses were observed in restored teeth due to root canal treatment and secondary caries. Treatment of the pulp was found to be more common in first molars than in second molars due to loss due to sepsis and caries. While the level of caries in the second molars was found to be close to the restoration rate, the loss rate of these teeth was found to be quite low. While the restoration rate in second molars was 34%, enamel and dentin caries were detected at 40%. No fissure sealants were detected on any of the examined tooth surfaces. The results of the correlation of the status of the permanent molars with the findings obtained as a result of the examination are given in table 3. A strong correlation was found between the condition of the teeth on the right and left side of the oral cavity. The correlation of the status of first and second teeth was stronger for the right than for the left side of the mouth, r was 0.603 and 0.456 in maxilla and 0.546 and 0.361 in mandible $p < 0{,}001$), respectively. The intra-examiner reliability was established at 0.80 for permanent molar teeth

Table 2: Distribution of caries in permanent molars of young adults according to the CAST index

Teeth	Sound	Sealent	Rest	Enamel	Dentine	Cavitation	Pulp	Abscess	Extracted	Total
Upper Right 1.	17%	0	41%	5%	0	7%	10%	9%	11%	%100 Eight hundred molar teeth
Upper left 1.	26%	0	40%	0	0	5%	7%	12%	10%	
Lower left 1.	8%	0	36%	8%	5%	7%	10%	13%	13%	
Lower right 1.	12%	2%	32%	4%	2%	8%	12%	15%	13%	
Upper Right 2.	30%	0	16%	10%	14%	14%	10%	6%	0	
Upper left 2.	32%	0	11%	5%	16%	14%	7%	9%	4%	
Lower left 2.	18%	0	28%	2%	6%	20%	11%	9%	6%	
Lower right 2.	23%	0	27%	0	8%	18%	10%	6%	6%	

Table 2: Distribution of caries in permanent molars of young adults according to the CAST index

Teeth matching	r değeri	p
16-17	0.603	p <0.001
26-27	0.456	p <0.001
36-37	0.361	p <0.001
46-47	0.546	p <0.001
16-46	0.476	p <0.001
17-47	0.408	p <0.001
26-36	0.518	p <0.001
27-37	0.356	p <0.001

Discussion

In our developing country, the fact that caries prevention programs are not seriously established and the restorative treatment approach still dominates the problem, causes both individual and social caries risk to continue to exist seriously. It is thought that the past caries status of individuals is an important indicator in caries risk detection. In developed countries, the majority of studies examining the relationship between caries risk prediction and past caries status have focused on the preschool and adolescence periods. It is reported that children with a high percentage of caries during childhood have a higher risk of caries than caries-free individuals during adolescence and beyond. Recently, the CAST index has been introduced for the purpose of caries detection criteria. While there are studies on this subject in some countries, there is no research report using this index in our country. That the period in which the potential for decay in permanent first molars is highest is the first 1-1.5 years, known as the period until the teeth reach occlusion, and this risk decreases over the years. Differences in the shapes, sizes and depths of the pits and fissures on the occlusal surface determine the tooth's susceptibility and resistance to caries. The steepness of the tubercle slopes on the occlusal surface and the depth of the fissures are important factors in caries formation. Deep fissures and pits; facilitates the accumulation of plaque, bacteria and food in these areas. Since saliva cannot effectively enter the fissures, the cleaning effect of saliva is limited and these areas are difficult to reach in terms of mechanical cleaning. Histological studies revealed a relationship between occlusal caries and the shape and depth of fissures. [10] With active caries in a primary dentition, the first permanent tooth that erupts in the mouth, the first molar tooth, decays rapidly because there is not enough time for

the enamel to mature. However, the permanent first molars that last in a mouth without caries have the opportunity to mature and their resistance to caries increases. It has been stated that 80% of the erupted permanent first molars in individuals with widespread caries decay within 2 years. It has been stated that it is the most determining factor in the predictions of the risk of permanent tooth decay in the future in individuals whose permanent first molars decay at a young age.

According to the results of the CAST index, 80% of the permanent first molars in our 20-25 years-old study group were found to be affected by caries. While 20% of them were considered as healthy without caries, 57% of them were restored, the other 23% were extracted, root canal treated or at different levels of caries. It has been determined proportionally that especially the lower first molars go to extraction and root canal treatment faster than the upper ones. Again, the lower first molars were found to be more unlucky than the upper ones in terms of survival. These teeth remain in the back of the mouth, remain between the first molars and wisdom teeth, and the lack of active plaque removal may be among the reasons for this situation. Perhaps the most striking benefit of the CAST index evaluated in this study is the detection of caries at different dentin levels, especially in permanent second molars.

According to a study conducted on 12-year-old children in Scotland, the degree of susceptibility of surfaces to tooth decay was evaluated. The occlusal surfaces of permanent first molars are the surfaces most affected by caries, these areas constitute 54.5% of the total caries surfaces, and after 3 years of follow-up, the percentage of caries on the occlusal surface reaches 48%. During this study period, recurrence of caries was observed at a rate of 39.8%. [20] In a study conducted in Finland on children aged 6-15, first molars were evaluated; in the 6-year-old group, 37% of the occlusal surfaces of the teeth were intact, 42% had fissure sealant applied, 5% had fillings and 16% had caries. detected. During the 8-year period, it was determined that only 19% of the occlusal surfaces were intact, 24% had fissure sealants, 50% had fillings and 5% had caries. [21] In our country, 5290 permanent teeth belonging to 600 children aged 4-12 were evaluated. While the permanent first molar caries percentage was 7.69% in the 6-year-old group, it was observed that this percentage increased with age, to 73.89% at the age of 9 and to 78.98% at the age of 12. At the same time, there was an increase in the rate of caries in permanent first molars after the age of 8, and the percentage of all caries was observed to peak at the age of 12. As a result, permanent first molars; These are the teeth with the most caries formation and early tooth extraction for many reasons. [19] In our research team's previous study on the subject, different caries risk groups were examined and the decay rate of permanent first molars was found to be 39% in the low caries risk group, 92% in the medium risk group and 99% in the high risk group.The prevalence of subjects with caries permanent molar teeth was high, which is in contrast with the results of a study by Dorenia *et al*., in Shimla. but is in line with the findings of a study by Shyam *et al*., in 2017 [24] reporting a lower level of caries-free in the first permanent molars in India. Considering a recent guideline on fissure sealant, it is strongly recommended that the use of sealants should be considered in permanent molars with both sound occlusal surfaces and non-cavitated occlusal carious lesions in children and adolescents.[25] Considering the low level of fluoride in drinking tap water in Tehran 0.39 mg/L), it is important for children to receive preventive care.

Although the DMFT/dmft index is simple and easy to apply, it does not reflect the need for dental care as filling and decay has the same score in the total DMFT/dmft. Comparison of other indices such as ICDAS and PUFA/pufa with the CAST index, which present more details on the caries status shows that although the ICDAS index provides detailed information, it is not applicable in field surveys since compressed air is needed to dry tooth surfaces.[27] The advantage of using the CAST index is that it reports a full spectrum of dental caries from sound to pulp involvement, abscess/fistula, and tooth loss as severe consequences of caries. Therefore, the CAST index is suitable for identification of the need for preventive and curative care at the same time. It also may help policy-makers to allocate more resources to high-risk subjects in advanced stages of caries having pain and infection. The CAST index was used in this study, which is more complicated than the DMFT/dmft index and therefore the process of calibration was time-consuming and more time was needed to reach consensus; however, using a visual aid was helpful.

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